JOLLT Journal of Languages and Language Teaching
https://e-journal.undikma.ac.id/index.php/jollt
Email: jollt@undikma.ac.id
DOI: https://doi.org/10.33394/jollt.v13i2.13596

April 2025. Vol. 13, No.2
p-ISSN: 2338-0810
e-ISSN: 2621-1378
pp. 568-583

THE EFFECT OF INTERACTIVE MULTIMEDIA ON STUDENTS EARLY READING SKILLS: A LESSON FROM REMOTE SCHOOLS

[1*]Asih Pujiariani, [1]Shely Cathrin
[1]Faculty of Education and Psychology, State University of Yogyakarta, Indonesia
*Corresponding Author Email: asihpujiariani@gmail

Article Info
Article History
Received: November 2024
Revised: February 2025
Published: April 2025

Keywords
Interactive multimedia;
Early reading skills;
Reading difficulties;
Elementary school;
Literacy;

Abstract

Amidst growing concerns over early literacy challenges in rural Indonesia, this study examines the impact of interactive multimedia on improving early reading skills among first-grade students at Banaran 2 Public Elementary School, in Temanggung Regency. The research adopts a Research and Development approach using the ADDIE model and employs a quasi-experimental time-series design. A purposive sampling method was used to select 21 first-grade students based on their early reading difficulties and access to computer facilities. Data collection methods included expert validation, questionnaires, interviews, observations, and reading tests. Findings indicate that the developed multimedia is highly suitable (91.67%) and practical (94.87%) for early reading instruction. Statistical analysis ($p < 0.005$) confirms its significant impact on students' reading abilities. These results suggest that interactive multimedia can serve as an effective tool for enhancing early literacy in elementary education, particularly in resource-limited settings. To maximize its potential, future research should explore its long-term effects and adaptation in diverse linguistic and educational contexts, providing valuable insights for curriculum development and technology integration in early childhood education.

How to cite: Pujiariani, A., & Cathrin, S. (2025). The Effect of Interactive Multimedia on Students' Early Reading Skills: A Lesson from Remote Schools. *JOLLT Journal of Languages and Language Teaching*,13(2), 568-583, DOI: https://doi.org/10.33394/jollt.v13i2.13596

INTRODUCTION

Education in Indonesia continues to develop in response to global dynamics and advances in science and technology. Improving the quality of education is crucial in facing these complex challenges, particularly in elementary schools, where early reading skills serve as a fundamental building block for academic success (Oktaviyanti et al., 2022). However, recent assessments indicate that nearly 30% of first-grade students in Indonesia struggle with reading skills (Hapsari, 2019; Hasanah & Lena, 2021; Ritonga & Rambe, 2022). This statistic underscores an urgent need for innovative solutions to improve early literacy.

Interviews conducted at several elementary schools in Temanggung Regency, including Kertosari 2 Public Elementary School, Kentengsari 2 Public Elementary School, Malangsari Public Elementary School, Pendowo 3 Public Elementary School, and Kramat Public Elementary School. confirm that many first-grade students struggle with basic reading skills. Several factors contribute to this issue, including the absence of systematic early reading instruction in preschool, limited instructional time dedicated to reading in elementary school, and insufficient learning resources at home and in schools (Nurulita et al., 2021; Rasmani et al., 2023). Additionally, low student motivation exacerbates the problem, with many children showing disengagement and a lack of interest in reading due to its perceived difficulty (Affiana Muthik et al., 2022; Hariyanto et al., 2021).

The issue of low early reading proficiency among first-grade students requires urgent attention, as it directly impacts their overall academic development. While efforts have been made to improve literacy instruction, existing challenges indicate a need for more effective and

engaging teaching strategies. Given the increasing role of technology in education, integrating interactive multimedia into early reading instruction presents a promising solution. To better understand this issue, the following literature review explores key aspects related to early literacy challenges, previous multimedia interventions, and the learning preferences of young students. To achieve these objectives, the study explores the following key research questions: (1) How effective is interactive multimedia in improving early reading skills among first-grade students? (2) To what extent does interactive multimedia influence students' motivation to learn to read? (3)What are the challenges and opportunities in implementing interactive multimedia in elementary schools, particularly in rural areas?

Literature Review

Challenges in Early Literacy

Early reading proficiency is a critical determinant of students' long-term academic success (Oktaviyanti et al., 2022b). In Indonesia, however, many first-grade students struggle with basic literacy skills, hindering their academic progress. Multiple interrelated factors contribute to these difficulties, including limited pre-reading exposure, inadequate instructional approaches, and low student motivation. Reading challenges in early education stem from various intellectual, environmental, and psychological factors. Cognitive abilities, home literacy environments, and emotional factors—such as motivation, interest, and self-confidence—significantly influence reading development (Soleha et al., 2021). Research highlights that students with limited exposure to reading at home, minimal parental guidance, and low intrinsic motivation often struggle more with early literacy skills (Adrian et al., 2024). Additionally, disparities in children's physical, psychological, and intellectual development further affect their reading abilities (Agustina & Rachmania, 2023). Socioeconomic factors play a role as well; students from low-income families often lack access to books and print-rich environments, which are essential for developing foundational literacy skills (McNally et al., 2024).

A significant obstacle to literacy development is the disconnect between early childhood education and elementary school instruction. While preschool programs typically focus on introducing letters, sounds, and basic vocabulary in a playful context, elementary curricula often assume students have already acquired these foundational skills (Hapsari, 2019; Rasmani et al., 2023). This instructional gap leaves many first-grade students unprepared for the more structured reading instruction they encounter, leading to early struggles in literacy acquisition (Kamilah et al., 2021). The quality and quantity of reading instruction in Indonesian elementary schools present additional challenges. Reading is often integrated into broader language arts lessons rather than treated as a distinct skill, limiting the focused practice necessary for literacy development (Rasmani et al., 2023). Furthermore, large class sizes and rigid curricula restrict teachers' ability to provide individualized support, particularly for struggling readers (Oktaviyanti et al., 2022b).

The Impact of Instructional Media on Reading Skills

One promising approach to improving both motivation and reading proficiency is the integration of instructional media into early literacy instruction. Research has shown that the use of appropriate instructional media can significantly enhance student motivation and engagement (Charline et al., 2023; Kustyarini et al., 2020; Mayangsari & Mahardhika, 2019). Interactive and visually appealing media can make abstract reading concepts more concrete, facilitating comprehension and retention.

Studies have demonstrated that the use of multimedia tools, such as interactive e-books, educational games, and audiovisual aids, can significantly improve early reading skills (Kim & Lee, 2016; Yiğit Gençten, 2023). For instance, Kim & Lee (2016) found that students exposed to interactive multimedia showed marked improvements in decoding skills, vocabulary

acquisition, and reading comprehension compared to those taught through traditional methods. Similarly, a meta-analysis by Yiğit Gençten (2023) revealed that multimedia-based instruction not only enhances literacy outcomes but also increases students' motivation and enthusiasm for reading. Furthermore, the Cognitive Theory of Multimedia Learning (Mayer, 2009) supports the idea that combining verbal and visual materials can improve students' understanding and retention of information. When applied to early reading instruction, multimedia resources can provide multisensory experiences that cater to diverse learning styles, making reading more accessible and enjoyable.

To maximize the benefits of instructional media in early reading instruction, educators must strategically select and implement appropriate tools. Studies emphasize the importance of aligning media with students' developmental levels and learning objectives (Charline et al., 2023). Teachers should also use interactive elements that encourage student participation, such as drag-and-drop activities, interactive storybooks, and gamified reading tasks. Moreover, combining multimedia with effective pedagogical strategies—such as scaffolding, collaborative learning, and differentiated instruction—can further enhance its impact. Puspitarini & Hanif (2019) highlight that when teachers actively engage students through dynamic and creative teaching methods, external motivation increases, leading to improved literacy outcomes.

Previous Multimedia Interventions

Multimedia has been widely recognized as an effective tool for enhancing student engagement and learning outcomes. Studies have shown that the use of digital media, including interactive multimedia, can significantly improve reading skills by making learning more engaging and accessible(Kamilah et al., 2021; Oktaviyanti et al., 2022b). However, research on multimedia interventions in rural settings is limited, and most existing studies focus on urban schools with better technological infrastructure (Kementerian Pendidikan Kebudayaan Riset dan Teknologi, n.d.; C. Wang et al., 2022). Comparative studies suggest that while multimedia is effective in various contexts, its implementation in under-resourced schools remains a challenge (Mohammed, 2018).

Multimedia has emerged as a powerful tool for enhancing student engagement and improving learning outcomes, particularly in early literacy development. Research has consistently shown that digital media, including interactive multimedia applications, can make learning more engaging and effective by providing multisensory experiences that reinforce reading skills (Kamilah et al., 2021; Oktaviyanti et al., 2022).

Several studies have explored the use of multimedia interventions in early literacy instruction. Digital applications that incorporate interactive storytelling, phonics-based games, and animated content have been shown to improve letter recognition, word decoding, and reading fluency (Vitvitskaya et al., 2022). These digital tools offer an immersive learning environment where students can interact with letters and words in a dynamic and visually stimulating way. Unlike traditional reading instruction that relies heavily on printed materials, multimedia-based approaches cater to the diverse learning styles of young children by integrating visual, auditory, and kinesthetic elements (Plakhotnik et al., 2022).

Digital Learning Preferences Among Young Students

The advancement of digital technology has significantly transformed education, especially in early childhood learning. Today’s children, often referred to as digital natives, grow up in a technology-rich environment that shapes their learning preferences and engagement styles. These students adapt quickly to technology and thrive in environments that integrate audio, video, and animation (Vitvitskaya et al., 2022). Research has shown that technology-driven learning captures students' attention, promotes independent learning, and deepens engagement (Zhao et al., 2022). As a result, understanding how to effectively integrate

technology into education has become essential for improving student learning outcomes (Chaudron et al., 2023).

Incorporating interactive multimedia into the classroom allows educators to align instruction with students' digital tendencies, ultimately enhancing early literacy outcomes. Interactive multimedia, especially when combined with game-based designs, supports student engagement and motivation. Gamification has been shown to make learning experiences more enjoyable and stimulating, improving both motivation and academic performance (Luarn et al., 2023; Seaborn & Fels, 2015). Additionally, interactive multimedia provides flexibility, enabling students to learn independently or with teacher guidance, anytime and anywhere. Integrating digital tools into the curriculum not only enhances the learning experience but also helps students develop essential technological skills, preparing them for future educational challenges (Sari & Alfiyan, 2023).

Research highlights that young children exhibit a strong interest in interactive digital media, which enhances their motivation and engagement in the learning process. Features such as high interactivity, captivating visuals, and adaptive difficulty levels tailored to individual progress make digital media particularly appealing to children (Flewitt et al., 2015). One of the most widely used forms of digital media in education is interactive multimedia with game-based designs. This type of media fosters active student engagement by encouraging learners to participate directly in the learning process. Children tend to be more motivated when they can interact with content through enjoyable and challenging game mechanics, creating a more dynamic learning environment (C.-C. Chen & Tu, 2021).

Game-based learning also enhances memory retention and conceptual understanding. Studies suggest that the repetitive nature of challenges within educational games helps solidify knowledge while keeping students engaged. Features like points, levels, and virtual rewards play a crucial role in maintaining students' focus and encouraging them to complete tasks (Meng et al., 2024). Moreover, interactive multimedia accommodates diverse learning styles more effectively than traditional methods. Visual learners benefit from animations and illustrations, while students who prefer hands-on or exploratory approaches can actively engage with educational games. This adaptability makes digital media a valuable tool for addressing the unique needs of each learner (Yulianci et al., 2021).

RESEARCH METHOD

Research Design

This study examines the issue of low early reading skills among first-grade students in Temanggung Regency, aiming to evaluate the effectiveness of interactive multimedia in enhancing their reading abilities. A Research and Development (R&D) approach was employed, focusing on both the development and assessment of an interactive multimedia product specifically designed to support early reading acquisition. The R&D method was chosen due to the limited availability of instructional media that align with the characteristics of students, who are digital natives. The study utilized the ADDIE model, adapted from Lee and Owens (2004), as its development framework. This model consists of five interrelated phases: assessment and analysis, design, development, implementation, and evaluation. The Lee and Owens model offers several advantages in multimedia or digital learning media development, including a systematic and structured approach, adaptability to various learning needs, and a strong emphasis on evaluation and revision, ensuring the effectiveness and usability of the final product.

In the initial assessment phase, the study identified the specific reading challenges faced by students and the technical constraints affecting multimedia use. Given that students came from rural areas with limited access to libraries and poor internet connectivity, the multimedia was designed to function offline and accommodate their learning needs. The design phase involved developing a structured blueprint that incorporated phonemic awareness, vocabulary

building, and basic reading skills into PowerPoint-based educational games. In the development stage, the multimedia product was created and refined through expert validation and small-scale testing. The implementation phase applied a quasi-experimental time-series design, assessing the multimedia's effectiveness in a real classroom setting over three months. Finally, the evaluation phase focused on measuring improvements in students' reading abilities while integrating feedback to enhance the product's effectiveness.

The quasi-experimental time-series design was selected to allow for continuous measurement of students' reading progress over time without the need for a control group. This approach was justified by the need to accommodate the small sample size and the ethical consideration of ensuring all students benefited from the intervention. Potential confounding variables, such as students' prior exposure to technology, were minimized through pre-intervention assessments and structured observations.

Participants

The study involved a purposive sample of 21 first-grade students (10 girls and 11 boys) from Banaran 2 Public Elementary School. These students came from families with low socioeconomic backgrounds and parents with limited formal education. Given their rural setting, access to digital learning resources was minimal, making this study particularly relevant in assessing the feasibility of multimedia interventions in similar contexts. The research was conducted in three phases: an individual trial involving four students, a small-scale test with eight students, and a field experiment that included all 21 students. Each phase provided data to evaluate the multimedia's effectiveness and ensure iterative improvements.

Instruments

A combination of quantitative and qualitative instruments was used to collect data. Reading ability tests, structured observations, questionnaires, and interviews provided comprehensive insights into the multimedia's impact. The reading test was designed to align with students' cognitive development and was adapted from established early literacy assessments. Expert validation questionnaires ensured the feasibility and appropriateness of the multimedia, gathering input from content specialists, media experts, and practitioners. Structured observations, supported by checklist-based observation sheets, systematically recorded students' engagement and interaction with the multimedia. Additionally, interviews with teachers, school principals, and students helped identify early reading challenges and provided feedback on the multimedia's usability.

Data Collection

Data collection was conducted across various stages of the research, ensuring a comprehensive analysis of the multimedia's effectiveness. Reading ability tests provided quantitative measurements of progress, while qualitative data from observations and interviews enriched the findings by capturing student engagement and contextual challenges. Ethical considerations were rigorously upheld, including obtaining informed consent from students' guardians, ensuring confidentiality, and fostering a supportive learning environment throughout the study. By incorporating both qualitative and quantitative data, controlling for potential confounding variables, and tailoring the multimedia to the specific constraints of the study environment, this research contributes valuable insights into the practical application of interactive multimedia for early reading development in rural settings.

Data Analysis

The study employed a quantitative descriptive approach to analyze the effectiveness of the interactive multimedia in enhancing early reading skills. Data analysis was divided into two main components: expert validation and early reading skills assessment. In the expert validation phase, feedback from content experts, media specialists, and practitioners was converted into

quantitative data using a four-point Likert scale. This approach allowed qualitative assessments of the multimedia's feasibility to be expressed numerically. The feasibility of the product was determined by calculating the percentage score based on the total obtained score relative to the maximum possible score.

To evaluate the effectiveness of the multimedia in improving early reading skills, a paired sample t-test was used to compare students' reading abilities before and after the intervention. The t-test was chosen because it is well-suited for analyzing repeated measurements within the same group, allowing for a direct comparison of pre-test and post-test scores. Before conducting the t-test, the normality and stability of pre-test data were assessed using Shapiro-Wilk's test and repeated measures ANOVA to ensure the data met the necessary assumptions. The hypothesis testing framework included a null hypothesis (H_0) stating that the multimedia had no significant effect on early reading skills, and an alternative hypothesis (H_1) suggesting a significant improvement. A significance level of $p<0.05$ was used to determine whether the observed differences were statistically meaningful.

Beyond significance testing, effect size calculations were incorporated to provide a deeper understanding of the intervention's impact. Effect size measures help contextualize whether observed improvements were educationally meaningful, rather than just statistically significant. Additionally, real-world interpretations of the findings were considered to enhance practical relevance. For instance, if students' reading test scores increased by an average of 40 points, this improvement would be translated into tangible literacy gains, such as enhanced fluency in recognizing simple words, better phonemic awareness, and increased reading confidence. These insights ensure that the results are not only statistically valid but also meaningful for educators and policymakers seeking effective literacy interventions.

RESEARCH FINDINGS AND DISCUSSION

Research Findings

Product Development Result

The interactive multimedia developed in this research is designed as an educational game that leverages interactive elements, such as buttons with hyperlinks, to enhance navigation and user engagement. These buttons serve as triggers for animations, creating an immersive learning experience tailored to young students. The multimedia product includes five main menus and nine educational games.

In line with the needs analysis, the interface is visually appealing, incorporating bright colors and images suited to elementary students' preferences. To support early learners who may be unfamiliar with text-based navigation, each page and button includes audio instructions. This ensures students can independently operate the multimedia during product trials. Examples of the multimedia design, as shown in Figure 1, depict a colorful, user-friendly layout geared toward engaging early readers.

Product Validation

Product validation conducted by subject matter expert, media expert. Meanwhile, practicability test conducted involving elementary school teachers. Subject matter experts evaluated two primary aspects: the quality of the content and the instructional quality. For content quality, seven key characteristics were assessed: accuracy, completeness, language proficiency, layout, sequence, the relevance of practice questions to content, and organization. Regarding instructional quality, the evaluation focused on comprehension, the impact on students, and assessment practices. The feasibility score of the interactive multimedia material in the subject matter validation test is 91.67%, categorized as "Highly Feasible."

In addition to subject matter experts, media experts also validated the feasibility of the interactive multimedia. The media experts evaluated the following aspects: (1) visual layout; (2) quality of video and animation; and (3) user-friendliness of the media. The data analysis

approach used for the validation findings by media experts was identical to that employed for the results from the subject matter experts. The validation result, indicate that the interactive multimedia was categorized as "Highly Feasible" based on the score conversion rules. The feasibility score was determined to be 92.64%.

The product developed is an interactive multimedia tool designed to enhance the motivation and early reading skills of first-grade elementary school children. Teachers, as educational professionals, undoubtedly play a crucial role in the effective utilization of the product. Therefore, feedback from practitioners/teachers regarding the product under development is considered as one of the data points collected during the product trial. The total score given by teachers was 153 out of a maximum score of 160, resulting in a media suitability rating of 95.63%. When compared to the conversion guidelines, according to the assessment of practitioners/teachers, the interactive multimedia falls into the "Highly Suitable" category."

The comparison of the experts validation and practicability test results with the minimum score requirement is depicted in the figure below:

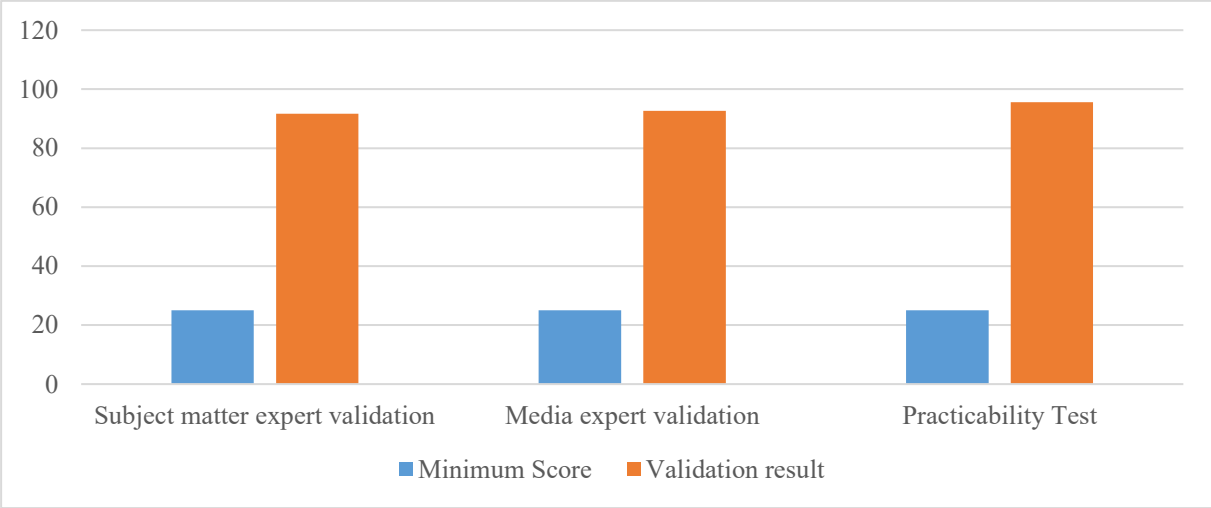

Figure 1. Experts Validation Results of Interactive Multimedia

The graph clearly illustrates that the score obtained from the interactive multimedia evaluation by experts exceeded the minimum required score. Based on the validation data, the interactive multimedia developed in this study is ready to be tested on students to evaluate its effectiveness.

Product Trial

During the product trial phase, the interactive multimedia was implemented with first-grade students to measure its impact on initial reading skills. This trial aimed to evaluate the product's effectiveness in a real learning context and identify measurable improvements in reading skills. Additionally, the data obtained from the pretest and posttest results served as the basis for more in-depth statistical analysis, involving tests for normality. This analyses were conducted to ensure that the data met the necessary assumptions for parametric statistical testing and that the product trial results could be interpreted validly.

Normality Test

Table 1 presents the results of the normality test, confirming that the pretest and posttest data for early reading skills are normally distributed. Both tests yielded significance values greater than 0.05, which indicates the data's normal distribution:

Table 1
The Results of Normality Tests

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Early Reading Skills Pretest	,167	21	,131	,925	21	,109
Early Reading Skills Postest	,146	21	,200*	,928	21	,126

Table 2 shows the results of the prerequisite test related to the normality of data conducted before hypothesis testing. The test results indicate a sig value of 0.109 for the pretest and 0.126 for the posttest. These values are greater than the α value of 0.05, so it can be said that both pretest and posttest data are normally distributed. After the normality of the pretest data is confirmed, interactive multimedia was implemented. The results of the field trial of the interactive multimedia in early reading learning can be described as follows:

Descriptive Statistical Analysis

The descriptive statistics for students' early reading skills, shown in Table 2, reveal a significant improvement in posttest scores compared to pretest scores, underscoring the effectiveness of the interactive multimedia.

Table 2
The Results of Descriptive Statistical Analysis

Descriptive Statistics						
	N	Range	Minimum	Maximum	Mean	Std. Deviation
Early Reading Skills Pretest	21	50	20	70	40,00	11,180
Early Reading Skills Postest	21	30	70	100	80,48	7,567
Valid N (listwise)	21					

Figure 3 shows the comparison of pretest and posttest scores. The comparison in Figure 3 illustrates the minimum, maximum, and mean scores at the pretest and posttest stages. The graph highlights an increase in all three aspects as a result of the implementation of the interactive multimedia. This upward trend reflects the positive impact of the multimedia on students' performance across various measures, underscoring its effectiveness as a learning tool.

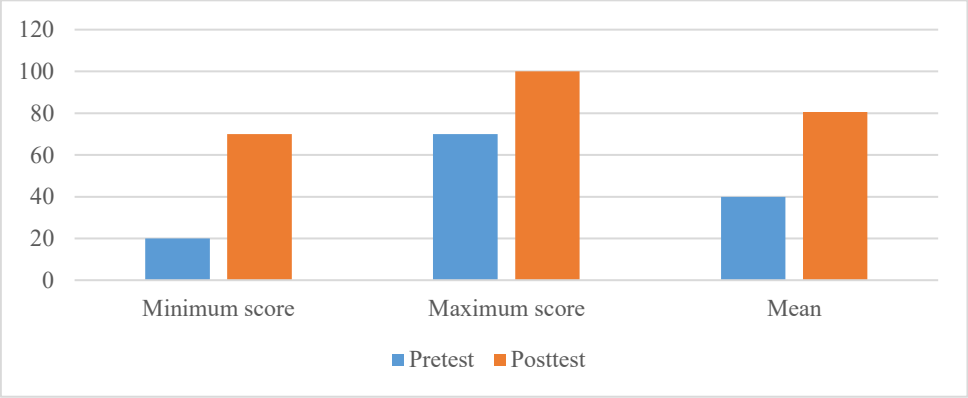

Figure 2. Comparison of Pretest and Posttest Scores

Descriptive statistics as shown above, provide insight into general trends. Furthermore, to confirm whether these differences are statistically meaningful, t-test is conducted. This step strengthens the validity of research findings, allowing for a clearer conclusion on the impact of the educational tool being studied.

Hypothesis Testing

The independent t-test results, shown in Table 3, reveal a statistically significant difference between pretest and posttest scores, indicating that the intervention effectively improved early reading skills.

Table 3
Independent T-test Result

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Early Reading Skills Pretest - Early Reading Skills Postest	-40,476	10,112	2,207	-45,079	-35,873	-18,342	20	,000

The results of the independent t-test, as seen in the table above, show a sig value of 0.000, which is smaller than the α value of 0.05. This indicates that the treatment given has a significant impact on the variable under investigation. In addition to the results of the independent t-test, the data distribution can be an additional consideration in determining the effectiveness of the developed product. The data distribution shown in Figure 4 below:

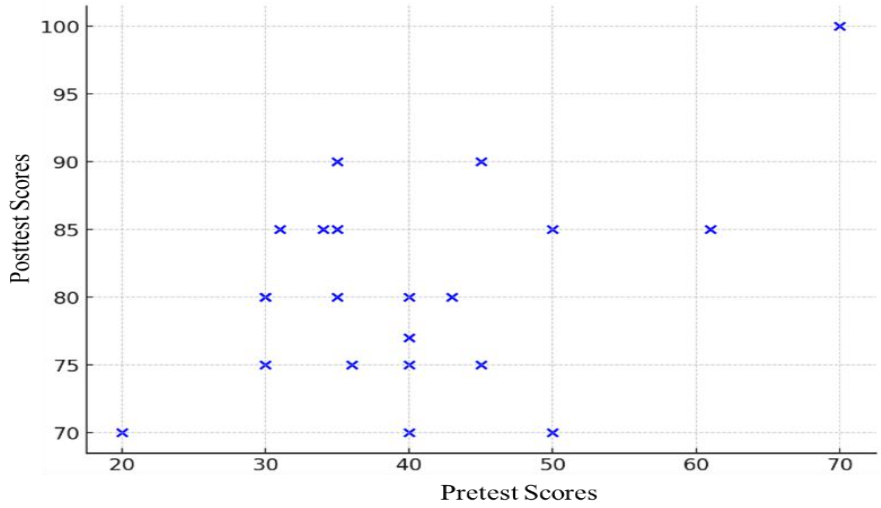

Figure 3. Scatter Plot of Pretest and Posttest Scores

Figure 3 illustrates the relationship between pretest and posttest scores, highlighting several key trends. The graph demonstrates a clear positive correlation, indicating that students who performed better in the pretest also tended to achieve higher posttest scores. Most data points are clustered in the lower to mid-range of the pretest scores, specifically between 30 and

50, with corresponding posttest scores widely dispersed between 70 and 90. This suggests that students with lower initial scores experienced significant improvements. Additionally, a few data points represent students with higher pretest scores, around 70, whose posttest scores approach the maximum value of 100, indicating consistently strong performance. While the pretest scores show a relatively tight clustering, posttest scores exhibit greater variability, reflecting differing degrees of progress among students. Some demonstrated substantial improvement, while others, despite similar pretest results, showed relatively lower posttest performance.

To further illustrate the impact of the interactive multimedia intervention, a line chart is provided below. This chart visually represents the progression of students' early reading skills from the pretest to the posttest. By tracking individual student scores, the chart highlights the overall trend of improvement, as well as variations in progress among students. The upward movement of most lines suggests a positive effect of the multimedia-based learning approach on early reading development.

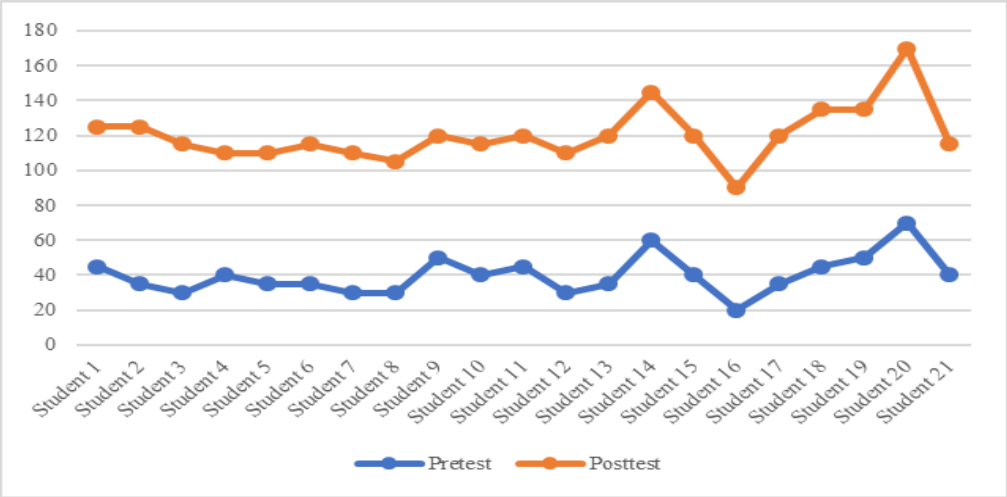

Figure 4. Individual Improvement in Early Reading Skills

Figure 4 displays the pretest and posttest scores for 21 students. The chart reveals a clear upward trend in students' reading performance after using the interactive multimedia. Each student experienced an improvement, as indicated by the posttest consistently being above the pretest. Some students, particularly those who started with lower pretest scores, exhibited significant gains, moving from around 20-40 points to 70-100 in the posttest. This suggests that the intervention was particularly effective in helping struggling readers. The overall pattern indicates that multimedia learning contributed to enhanced early reading skills, supporting the statistical findings that showed a significant difference between pretest and posttest results..

Discussion

Empirical Evidence of Effectiveness

The effectiveness of the interactive multimedia is supported by empirical evidence. A trial conducted with 21 first-grade students revealed a dramatic improvement in their reading skills over three months. The average reading score increased from 40.00 to 80.48, demonstrating the multimedia's impact on learning outcomes. Furthermore, 90.47% of the students reported feeling more motivated to learn to read compared to traditional teaching methods.

This improvement highlights the importance of innovative educational tools in addressing gaps in conventional methods. Traditional approaches often rely on rote learning and lack the interactive and engaging elements necessary for young learners. In contrast, interactive

multimedia provides a dynamic, student-centered platform that combines education with entertainment, making it more effective in achieving literacy objectives.

Interactive multimedia design offers significant advantages in supporting early reading learning for first-grade students. One of its standout features is its high level of interactivity, which empowers students to navigate learning materials independently. By incorporating buttons, icons, and other interactive elements, the multimedia fosters a sense of autonomy, allowing learners to determine their own study sequence and pace. This flexibility is particularly beneficial for young learners, as it accommodates diverse learning paces and styles. Research has shown that interactive tools significantly enhance engagement and encourage active participation, which are critical components in mastering foundational skills like early reading (Yiğit Gençten, 2023).

Beyond engagement, interactivity transforms passive learning into an active experience by providing immediate feedback on student actions. This feedback loop plays a crucial role in reinforcing correct responses and addressing mistakes promptly (Yaseen et al., 2025). For example, when students practice blending syllables or reading simple words, the system provides instant feedback, strengthening their understanding and retention of concepts. By reducing the time between action and correction, students internalize learning material more effectively. Wang & Walker (2021) highlight that timely feedback is particularly crucial in foundational literacy development, as it supports comprehension and long-term retention.

The visual design of the multimedia is also strategically crafted to enhance learning. Bright pastel colors, engaging illustrations, and dynamic animations make the learning experience enjoyable while catering to children's visual preferences. These elements not only capture and sustain attention but also help reduce cognitive load, making learning more effective. According to Liew et al. (2022) and Meusel et al. (2024), visually appealing educational tools enhance memory retention, enabling students to recall and apply learned concepts more effectively. Additionally, the child-friendly aesthetic creates an environment that feels less like a classroom and more like a playful adventure, which helps foster intrinsic motivation (Luarn et al., 2023).

Another notable feature of the multimedia is its gamified elements, which make learning more engaging and enjoyable. These include syllable reading games, quizzes, and reward-based challenges that provide students with virtual stickers or points as incentives. Gamification has been widely recognized for its ability to increase motivation and encourage repetition—a key factor in mastering reading skills (Luarn et al., 2023; Zhao et al., 2022). The repetitive nature of gamified activities, combined with their entertainment value, ensures that students practice essential reading skills more frequently and with greater enthusiasm. Zhao et al. (2022) found that gamified learning tools significantly improve students' literacy outcomes, particularly in areas that require frequent practice, such as reading fluency.

Impact on Student Motivation and Independent Learning

By focusing on student-centered learning, this interactive multimedia helps young learners develop independence, motivation, and literacy skills in an engaging way. Its design encourages active participation, self-paced learning, and immediate feedback, allowing students to progress comfortably at their own pace. With a combination of interactivity, visual appeal, and gamification, the multimedia provides an effective and enjoyable way for first-grade students to build their early reading skills.

While the multimedia itself is designed to be engaging, its ability to boost student motivation is equally noteworthy. Motivation plays a crucial role in determining learning outcomes. When students are motivated, they are more likely to invest effort, stay focused, and engage actively with the material. Studies by (Muthik et al. (2022) and Palittin et al. (2019) confirm that higher levels of motivation lead to better academic performance.

Additionally, the multimedia's design encourages students to learn independently. By providing access to a variety of activities and materials, it reduces reliance on teachers and fosters a sense of responsibility in students. Features such as self-paced modules and interactive games empower students to revisit and reinforce concepts at their own pace. This approach aligns with modern pedagogical practices that prioritize student autonomy and active learning. (Nadeem et al. (2023) highlight the importance of tools that allow students to engage with content independently, as this promotes deeper understanding and better retention.

Comparison with Global Digital Literacy Initiatives

This study contributes to existing research by demonstrating how interactive multimedia specifically enhances early literacy development in young learners. While previous studies have established the benefits of digital tools in education, fewer have focused on their direct impact on first-grade students in early reading contexts. The results highlight the importance of incorporating multimedia elements tailored to young learners' cognitive and motivational needs, addressing a gap in traditional literacy education methods.

Research indicates that digitally enhanced reading interventions can significantly improve literacy outcomes, even in resource-limited settings. A study by Vavasseur et al. (2016) explored the impact of integrating iPads into reading instruction for struggling readers in elementary grades. The mixed-method research involved teacher education candidates who utilized iPads to deliver reading interventions to students identified as below grade level in reading. Findings revealed that the inclusion of technology not only heightened student engagement but also led to notable improvements in reading achievement across five key areas of effective reading instruction. This suggests that well-designed digital tools can effectively support literacy development, even when traditional resources are scarce(Vavasseur et al., 2016).

Similarly, a study by Abdul Samat & Abdul Aziz (2020) examined the effectiveness of multimedia learning in enhancing reading comprehension among indigenous students in Malaysia. The research involved implementing multimedia elements—such as animations, audio, and interactive exercises—into reading lessons for primary school students. Findings indicated that students exposed to these multimedia-enriched lessons demonstrated significant improvements in reading comprehension compared to those who received traditional instruction. This suggests that integrating well-designed multimedia resources can effectively support literacy development, even in educational settings with limited resources. These studies highlight that, despite infrastructural constraints, the strategic implementation of interactive multimedia and digital resources can lead to substantial improvements in reading outcomes. Such approaches offer scalable and effective solutions to address literacy challenges in diverse educational contexts.

CONCLUSION

This study highlights the transformative potential of interactive multimedia in revolutionizing early literacy education, particularly in resource-limited settings. The research findings confirm that the developed multimedia is highly suitable for first-grade early reading instruction, as validated by content and media experts, who rated it as "Very Suitable." Additionally, the high practicality rating from practitioners further underscores its ease of use in classroom settings. Most importantly, the effectiveness of this multimedia in enhancing students' early reading skills is statistically supported by a significant improvement in posttest scores. Beyond these findings, this study has broader implications for educators, policymakers, and researchers. Educators can integrate interactive multimedia into early literacy instruction to enhance engagement and accommodate diverse learning paces. Policymakers should consider supporting the adoption of digital learning tools, ensuring accessibility across different regions, including those with limited infrastructure. Future research should explore the long-

term impact of interactive multimedia on literacy development and assess its applicability in different linguistic and cultural contexts. By continuing to innovate and expand digital literacy initiatives, interactive multimedia can play a crucial role in shaping the future of early reading education.

REFERENCES

Abdul Samat, M. S., & Abdul Aziz, A. (2020). The Effectiveness of Multimedia Learning in Enhancing Reading Comprehension Among Indigenous Pupils. *Arab World English Journal*, *11*(2), 290–302. https://doi.org/10.24093/awej/vol11no2.20

Adrian, P., Nisa, C., Chandra, C., & Wijanarko, T. (2024). Analisis Faktor Penyebab Kesulitan Membaca Permulaan Pada Siswa Kelas II Sekolah Dasar. *Protasis: Jurnal Bahasa, Sastra, Budaya, Dan Pengajarannya*, *3*(1), 183–196. https://doi.org/10.55606/protasis.v3i1.153

Affiana Muthik, Muchyidin, A., & Alif Ringga Persada. (2022). The Effectiveness Of Students' Learning Motivation On Learning Outcomes Using The Reciprocal Teaching Learning Model. *Journal of General Education and Humanities*, *1*(1), 21–30. https://doi.org/10.58421/gehu.v1i1.7

Agustina, E., & Rachmania, S. (2023). Faktor-Faktor Penyebab Terjadinya Kesulitan Membaca Permulaan di Kelas I Sekolah Dasar Negeri Wangiwisata. *Sistem-Among : Jurnal Pendidikan Sekolah Dasar*, *3*(1), 1–7. https://doi.org/10.56393/sistemamong.v3i1.1558

Al-Ajmi, N. H., & Aljazzaf, Z. (2020). Factors Influencing the Use of Multimedia Technologies in Teaching English Language in Kuwait. *International Journal of Emerging Technologies in Learning (IJET)*, *15*(05), 212–234. https://doi.org/10.3991/ijet.v15i05.12277

Borusilaban, L. J. A., & Harsiwi, N. E. (2023). Analisis Faktor Penghambat Membaca Permulaan Siswa Kelas I. *Jurnal Basicedu*, *7*(4), 2502–2509. https://doi.org/10.31004/basicedu.v7i4.6014

Charline, C., Jo, S., & Frederic, E. (2023). Use of Learning Media to Increase Student Learning Motivation in Junior High Schools. *World Psychology*, *2*(3), 176–189. https://doi.org/10.55849/wp.v2i3.402

Chaudron, S., Di Gioia, R., Marin, C. A., Topić, M. K., Letnes, M.-A., Lobe, B., Matsumoto, M., Mifsud, C. L., Poveda, D., & Velicu, A. (2023). Studying the Media Education Practices of Young Children at Home. In *Media Literacy and Media Education Research Methods* (pp. 45–61). Routledge. https://doi.org/10.4324/9781003045366-4

Chen, C.-C., & Tu, H.-Y. (2021). The Effect of Digital Game-Based Learning on Learning Motivation and Performance Under Social Cognitive Theory and Entrepreneurial Thinking. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.750711

Chen, C.-M., Tan, C.-C., & Lo, B.-J. (2016). Facilitating English-language learners' oral reading fluency with digital pen technology. *Interactive Learning Environments*, *24*(1), 96–118. https://doi.org/10.1080/10494820.2013.817442

Flewitt, R., Messer, D., & Kucirkova, N. (2015). New directions for early literacy in a digital age: The iPad. *Journal of Early Childhood Literacy*, *15*(3), 289–310. https://doi.org/10.1177/1468798414533560

Hapsari, E. D. (2019). Penerapan membaca permulaan untuk meningkatkan kemampuan membaca siswa. *Aksara: Jurnal Bahasa Dan Sastra*, *20*(1), 10–24. https://doi.org/http://dx.doi.org/10.23960/aksara/v20i1.pp10-24

Hariyanto, D., Arafat, Y., & Wardiah, D. (2021). The Effect of Facilities and Motivation on Learning Outcomes of High School Students in Gelumbang, Indonesia. *Journal of Social Work and Science Education*, *2*(1), 95–108. https://doi.org/10.52690/jswse.v2i1.210

Hasanah, A., & Lena, M. S. (2021). Analisis Kemampuan Membaca Permulaan dan Kesulitan yang Dihadapi Siswa Sekolah Dasar. *EDUKATIF : JURNAL ILMU PENDIDIKAN*, *3*(5), 3296–3307. https://doi.org/10.31004/edukatif.v3i5.526

Huda, S. (2024). Challenges of Using Multimedia Tools in the Teaching and Learning Process: Instance from a college of Bangladesh. *Journal of Management and Business Education*, *7*(3), 435–451. https://doi.org/10.35564/jmbe.2024.0024

Kamilah, A., Mugara, R., & Ruqoyyah, S. (2021). Pembelajaran Daring Membaca Permulaan Siswa Kelas 1 SD Menggunakan Model Contextual Teaching and Learning Berbantuan Kartu Kata. *JIPA : Jurnal Ilmu Pendidikan Ahlussunnah*, *4*(1), 218-226,. https://www.ojs.stkip-ahlussunnah.ac.id/index.php/jipa/article/view/146

Kementerian Pendidikan Kebudayaan Riset dan Teknologi. (2023). *Laporan Kinerja 2022*. https://roren.kemdikbud.go.id/wp-content/uploads/2023/12/Lakin-Kemendikbud-2022.pdf

Kim, S., & Lee, Y. (2016). iStoryBook: An interactive media supporting dialogic reading for children's reading comprehension. *International Journal of Multimedia and Ubiquitous Engineering*, *11*(11), 383–392. https://doi.org/10.14257/ijmue.2016.11.11.35

Kuron, M. A., & Tompodung, M. L. (2020). Development of Integrated Offline Learning Multimedia to Improve Student Learning Out Comes. *International Journal of Global Operations Research*, *1*(1), 6–19. https://doi.org/10.47194/ijgor.v1i1.14

Kustyarini, K., Utami, S., & Koesmijati, E. (2020). The importance of interactive learning media in a new civilization era. *European Journal of Open Education and E-Learning Studies*, *5*(2). https://doi.org/http://dx.doi.org/10.46827/ejoe.v5i2.3298

Liew, T. W., Tan, S.-M., Gan, C. L., & Pang, W. M. (2022). Colors and Learner's Gender Evoke Different Emotional and Cognitive Effects in Multimedia Learning. *Human Behavior and Emerging Technologies*, *2022*, 1–15. https://doi.org/10.1155/2022/1235732

Luarn, P., Chen, C.-C., & Chiu, Y.-P. (2023). Enhancing intrinsic learning motivation through gamification: a self-determination theory perspective. *The International Journal of Information and Learning Technology*, *40*(5), 413–424. https://doi.org/10.1108/IJILT-07-2022-0145

McNally, S., Leech, K. A., Corriveau, K. H., & Daly, M. (2024). Indirect Effects of Early Shared Reading and Access to Books on Reading Vocabulary in Middle Childhood. *Scientific Studies of Reading*, *28*(1), 42–59. https://doi.org/10.1080/10888438.2023.2220846

Meng, C., Zhao, M., Pan, Z., Pan, Q., & Bonk, C. J. (2024). Investigating the impact of gamification components on online learners' engagement. *Smart Learning Environments*, *11*(1), 47. https://doi.org/10.1186/s40561-024-00336-3

Meusel, F., Scheller, N., Rey, G. D., & Schneider, S. (2024). The influence of content-relevant background color as a retrieval cue on learning with multimedia. *Education and Information Technologies*. https://doi.org/10.1007/s10639-024-12460-1

Mohammed, I. (2018). Predominant factors contributing to low reading abilities of pupils at Elsie Lund Basic School in the Tamale Metropolis, Ghana. *African Educational Research Journal*, *6*(4), 273–278. https://doi.org/10.30918/AERJ.64.18.071

Muthik, A., Muchyidin, A., & Alif Ringga Persada. (2022). The Effectiveness Of Students' Learning Motivation On Learning Outcomes Using The Reciprocal Teaching Learning Model. *Journal of General Education and Humanities*, *1*(1), 21–30. https://doi.org/10.58421/gehu.v1i1.7

Nadeem, M., Oroszlanyova, M., & Farag, W. (2023). Effect of digital game-based learning on student engagement and motivation. *Computers*, *12*(9), 177. https://doi.org/https://doi.org/10.3390/computers12090177

Nurulita, A., Fauzi, N., Drupadi, R., & Syafrudin, U. (2021). *Pemahaman Guru PAUD terhadap Pembelajaran Membaca Permulaan Anak Usia Dini*. *4*(1), 17–25. https://doi.org/10.24014/kjiece.v4i1.11959

Oktaviyanti, I., Amanatulah, D. A., Nurhasanah, N., & Novitasari, S. (2022a). Analisis Pengaruh Media Gambar terhadap Kemampuan Membaca Permulaan Siswa Sekolah Dasar. *Jurnal Basicedu*, *6*(4), 5589–5597. https://doi.org/https://doi.org/10.31004/basicedu.v6i4.2719

Oktaviyanti, I., Amanatulah, D. A., Nurhasanah, N., & Novitasari, S. (2022b). Analisis Pengaruh Media Gambar terhadap Kemampuan Membaca Permulaan Siswa Sekolah Dasar. *Jurnal Basicedu*, *6*(4), 5589–5597. https://doi.org/10.31004/basicedu.v6i4.2719

Oliveira, W., Hamari, J., Shi, L., Toda, A. M., Rodrigues, L., Palomino, P. T., & Isotani, S. (2023). Tailored gamification in education: A literature review and future agenda. *Education and Information Technologies*, *28*(1), 373–406. https://doi.org/10.1007/s10639-022-11122-4

Panjeti-Madan, V. N., & Ranganathan, P. (2023). Impact of Screen Time on Children's Development: Cognitive, Language, Physical, and Social and Emotional Domains. *Multimodal Technologies and Interaction*, *7*(5), 52. https://doi.org/10.3390/mti7050052

Plakhotnik, O., Strazhnikova, I., Yehorova, I., Semchuk, S., Tymchenko, A., Logvinova, Y., & Kuchai, O. (2022). The Importance of Multimedia for Professional Training of Future Specialists. *IJCSNS International Journal of Computer Science and Network Security*, *22*(9), 43–50. https://doi.org/https://doi.org/10.22937/IJCSNS.2022.22.9.7

Puspitarini, Y. D., & Hanif, M. (2019). Using Learning Media to Increase Learning Motivation in Elementary School. *Anatolian Journal of Education*, *4*(2), 53–60. https://doi.org/10.29333/aje.2019.426a

Rasmani, U. E. E., Wahyuningsih, S., Nurjanah, N. E., Jumiatmoko, J., Widiastuti, Y. K. W., & Agustina, P. (2023). Multimedia Pembelajaran Interaktif untuk Guru PAUD. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *7*(1), 10–16. https://doi.org/10.31004/obsesi.v7i1.3480

Ritonga, S., & Rambe, R. N. (2022). Penggunaan media big book dalam meningkatkan kemampuan membaca permulaan siswa kelas rendah sekolah dasar. *Jurnal Cakrawala Pendas*, *8*(4). https://doi.org/http://dx.doi.org/10.31949/jcp.v8i2.3129

Sari, D. N., & Alfiyan, A. R. (2023). Peran Adaptasi Game (Gamifikasi) dalam Pembelajaran untuk Menguatkan Literasi Digital: Systematic Literature Review. *UPGRADE : Jurnal Pendidikan Teknologi Informasi*, *1*(1), 43–52. https://doi.org/10.30812/upgrade.v1i1.3157

Soleha, R. S., Enawar, E., Fadhillah, D., & Sumiyani, S. (2021). Analisis Kesulitan Membaca Permulaan pada Siswa Kelas II Sekolah Dasar. *Berajah Journal*, *2*(1). https://doi.org/10.47353/bj.v2i1.50

Surtikayati, Y., & Ritonga, R. (2023). Peningkatan Kemampuan Membaca Permulaan Menggunakan Metode Multisensori Siswa Kelas I Sekolah Dasar. *Mitra Pilar: Jurnal Pendidikan, Inovasi, Dan Terapan Teknologi*, *2*(2), 53–62. https://doi.org/10.58797/pilar.0202.02

Thohir, L. (2017). Motivation in a Foreign Language Teaching and Learning. *Vision: Journal for Language and Foreign Language Learning*, *6*(1), 20–29. https://doi.org/10.21580/vjv6i11580

Vavasseur, C. B., Crochet, F., & Dempster, S. (2016). The Impact of Digitally Enhanced Reading Interventions on Struggling Readers and Teacher Education Candidates. *Open Journal of Social Sciences*, *04*(11), 97–112. https://doi.org/10.4236/jss.2016.411008

Vitvitskaya, O., Suyo-Vega, J. A., Meneses-La-Riva, M. E., & Fernández-Bedoya, V. H. (2022). Behaviours and characteristics of digital natives throughout the teaching-learning process: a systematic review of scientific literature from 2016 to 2021. *Academic Journal*

of Interdisciplinary Studies, *11*(3), 38–49. https://doi.org/https://doi.org/10.36941/ajis-2022-0066

Wang, C., Zhang, M., Sesunan, A., & Yolanda, L. (2022). *Peran Teknologi dalam Transformasi Pendidikan di Indonesia - Tinjauan dampak terkini gerakan Merdeka Belajar*. https://roren.kemdikbud.go.id/wp-content/uploads/2023/12/Lakin-Kemendikbud-2022.pdf

Wang, S., & Walker, E. (2021). Providing Adaptive Feedback in Concept Mapping to Improve Reading Comprehension. *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, 1–11. https://doi.org/10.1145/3411764.3445554

Yaseen, H., Mohammad, A. S., Ashal, N., Abusaimeh, H., Ali, A., & Sharabati, A.-A. A. (2025). The Impact of Adaptive Learning Technologies, Personalized Feedback, and Interactive AI Tools on Student Engagement: The Moderating Role of Digital Literacy. *Sustainability*, *17*(3), 1133. https://doi.org/10.3390/su17031133

Yiğit Gençten, V. (2023). Technology-Assisted Interactive Reading Activities in Early Childhood Education: *International Journal of Education Technology and Scientific Researches*. https://doi.org/10.35826/ijetsar.676

Yulianci, S., Nurjumiati, N., Asriyadin, A., & Adiansha, A. A. (2021). The Effect of Interactive Multimedia and Learning Styles on Students' Physics Creative Thinking Skills. *Jurnal Penelitian Pendidikan IPA*, *7*(1), 87–91. https://doi.org/10.29303/jppipa.v7i1.529

Zhao, D., Muntean, C. H., Chis, A. E., Rozinaj, G., & Muntean, G.-M. (2022). Game-Based Learning: Enhancing Student Experience, Knowledge Gain, and Usability in Higher Education Programming Courses. *IEEE Transactions on Education*, *65*(4), 502–513. https://doi.org/10.1109/TE.2021.3136914